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Bridging the Gap Economic Accessibility of AI-Enabled Dental Care in Low- and Middle-Income Setting

Abstract
AI's influence on healthcare systems is reshaping the health industry in many ways, including providing accurate diagnostics, creating treatment plans, and improving access to healthcare. The economic viability of AI-based oral health intervention in low and middle-income communities, however, hasn't been thoroughly studied. The purpose of this study is to investigate the accessibility, affordability, acceptance and barriers of using AI in dental care services in resource-poor environments. This research is quantitative research design with cross sectional method and sampling is done by conveniant sampling with number of sample respondents 50 respondents. The data were analyzed using descriptive statistics, reliability analysis, correlation analysis and the regression interpretation method of Microsoft Excel. The findings revealed that the respondents overall positively perceived the economic advantages of AI-assisted dental care since this could contribute to decreasing the cost of care, the amount of time spent in the waiting area, and the distance to dental services as well as provide remote consultations. The results suggest that AI-powered dental services can contribute to more inclusive and sustainable dental care systems, given that there are effective policy frameworks, government investments, and fair digital healthcare approaches. The study underscores the need to embed AI technologies into oral health delivery systems to enhance access to oral health care and mitigate oral health care inequalities in low-resource areas.

Keywords: Dental Care, Economic Accessibility, Oral Healthcare, Low- and Middle-Income Countries, Healthcare Equity

1. Introduction

The field of artificial intelligence (AI) has become one of the most disruptive technologies in the contemporary healthcare system, impacting the diagnostic accuracy, treatment planning, and access to healthcare significantly. Over the past few years, AI has become more widely spread in dental healthcare, with machine learning, deep learning, and predictive algorithms starting to be applied to enhance oral disease diagnostics, radiographic interpretation, and clinical decision-making (Schwendicke et al., 2020). The development of AI in the healthcare industry has increased the digital transformation of dentistry through quicker, more precise and data-driven oral healthcare services (Meskó et al., 2018).

Modern dentistry is now equipped with AI-driven diagnostic imaging, predictive analytics, teledentistry, robotics, and automated treatment planning systems that enhance clinical outcomes and operational efficiencies (Dua et al., 2025). The use of AI in the field of dentistry has proved to be quite useful in identifying dental caries, periodontal diseases, and oral abnormalities via sophisticated imaging technologies. Dental radiograph and diagnostic prediction have demonstrated outstanding performance by deep learning algorithms (Lee et al., 2018). Likewise, machine learning models have been used effectively in predicting root caries and progression of oral disease (Hung et al., 2019). Cone beam

Keywords
Guided implant surgery, Conventional implant placement, Computer-assisted implant surgery, Dynamic navigation, Static guided surgery

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computed tomography (CBCT) systems with the aid of AI have also led to the improvement of diagnostic accuracy and the decrease in human error in oral health care facilities (Ezhov et al., 2021). Besides, dental medicine has experienced some more novel approaches to treatment planning and clinical training as a result of implementing augmented reality and virtual reality (Joda et al., 2019).

Oral diseases remain a significant global health challenge despite the technological advances, and in particular, in low- and middle-income countries (LMICs). Poor access to dental care, inability to get proper healthcare and economic aspects have contributed to the rise in the number of untreated oral diseases in these regions. Dental disparity remains an issue because of the lack of dental professionals, poor dental insurance access, and high cost of treatments. This affects the rural population and underserved populations more because the dental health facilities are typically located in the urban centres. Therefore, one of the reasons why many people put off or even evade dental treatment is due to their financial constraints and inaccessibility.

Of utmost importance is economic barriers to quality dental care in LMICs as well. The cost of consultation is high, diagnostic tests are very costly, transportation costs, and availability of specialists further add to the cost burden of patients. In most developing economies, the oral healthcare centres are not ranked in the government healthcare programs and treatment of the teeth is left to the individual pocket. Moreover, the shortage of healthcare providers also increases the disparity in access among remote and low-resource communities (Meskó et al., 2018). These concerns highlight the urgent need to take new and cost-effective models of healthcare provision that can improve access to oral healthcare.

Dental care AI has become a hopeful remedy to overcome these economic and accessibility issues. With the help of AI technologies, it might be possible to conserve funds due to automatization of work, the efficiency of diagnostics, and the access to remote consultations with the help of teledentistry products (Estai et al., 2018). The implementation of AI-supported systems can result in the optimization of resource allocation in underserved settings as well since it enables the detection of diseases as quickly as possible and reduces the rate of clinical encounter. Recent findings have indicated that AI-assisted dentistry could transform the field of oral healthcare with enhanced efficiency, lowered cost, and patient outcomes (Sikri et al., 2024).

Telehealth models offering AI assistance can be particularly helpful to rural population as they make traveling less expensive and help people get access to specialized dental services. The use of AI and its efficacy in dentistry have been studied in multiple studies, but few studies have explored the economic accessibility of AI-based dentistry in LMICs in particular (Ahmed et al., 2021; Khanagar et al., 2021). Existing literature focuses primarily on the advancement of technology and the clinical effectiveness of AI-based dental care systems, and does not pay due attention to the issues of affordability, equity and sustainability of AI-based systems. Moreover, economic evaluations of the implementation of AI in dental care based on policy-driven methods have not been elaborated to this degree, particularly in situations where resources are limited.

In this way, the present study aims to explore the accessibility of AI-driven dental services in the low- and middle-income neighborhoods. The study will identify barrier and opportunity issues associated with AI implementation in dental practice, evaluate the cost-effectiveness and affordability of AI solutions, and policy-wise recommend how to equitably implement AI-driven oral healthcare solutions to people. This research has the potential to contribute to the literature on digital health equity and holistic oral healthcare creation in the developing economies by bridging the intersections between artificial intelligence, healthcare access, and sustainability.

2. Methodology

2.1 Research Design

The present study adopted a quantitative research design to investigate the economic accessibility of AI-enabled dental care in low- and middle-income settings. The research employed a cross-sectional survey design since it enables the researcher to gather data on the respondents at one time and determine their perception about the affordability, accessibility, barriers and acceptance of artificial intelligence technologies in dental care. The quantitative approach was deemed suitable since the aim of the study was to quantify the attitudes and opinions and to determine the relationships between the chosen variables. The study was based solely on Microsoft Excel to organize the data and to analyze the statistical data. Excel was chosen because it is appropriate in handling datasets based on surveys, descriptive statistical analysis, reliability test, correlation analysis, and regression analysis to carry out exploratory research in healthcare.

2.2 Research Approach

The research employed a deductive research methodology where the research objectives and hypotheses were developed based on existing ideas concerning healthcare accessibility, digital health technologies and the adoption of AI in healthcare. The survey data gathered were analyzed to establish whether the respondents saw AI-enabled dental care as economically available and useful in the resource-limited environment.

2.3 Population and Sampling

The study's target population included people who reside in low or middle income areas and are potentially eligible for dental care. The study included people from diverse backgrounds to capture public perceptions of the affordability and accessibility of dental care with AI, as this is the focus area.

50 people participated in the survey. The number of samples was deemed satisfactory for the purpose of exploratory quantitative research for the research purposes. The selection of the respondents was

conducted through convenience sampling as they were the ones who were available, accessible, and willing to participate in the study. This sampling technique was suitable due to limited time and resource availability.

2.4 Data Collection Procedure

An organized questionnaire was developed and to gather primary data. The questionnaire was given electronically and the respondents were left to give their answers on a voluntary basis. The data collected was tabulated using an excel data set to be analyzed in the future. The survey had demographic questions and perception-related questions that were interested in awareness of AI-enabled dentistry, affordability, obstacles to adoption, and intention to use AI technologies in dentistry.

2.5 Questionnaire Structure

The questionnaire was made up of 20 questions in various thematic sections. The demographic information, i.e. gender, age group, geographical location, income level, and past use of AI-assisted healthcare services was collected in the former section. The remaining sections measured perception of respondents regarding the accessibility, affordability, technological barrier and policy assistance towards AI-enabled dental care. The questions that entailed perception were evaluated based on a five point Likert scale that included the Strongly Disagree to Strongly Agree. The scale scores were in a range of 1-5 with higher scores indicating a greater agreement with the statement presented.

2.6 Variables of the Study

The study focused on various independent factors such as awareness of AI in dental health care, economic accessibility, and challenges in the acceptance of AI. The dependent variable of the study was the acceptance of the dental care service with the use of artificial intelligence. These variables have been chosen to determine the effect of awareness and affordability on how people in low and middle-income countries accept AI-based dental technologies.

2.7 Data Analysis Method

All the data gathered were analyzed in Microsoft Excel. To be analyzed statistically, these answers were first washed, coded and tabulated into numbers. The demographics of the respondents and overall pattern of responses were summarized with the help of descriptive statistics such as frequency distribution, percentages, mean scores and standard deviation. Cronbachs Alpha was used to undertake reliability analysis to determine the internal consistency of the questions in the questionnaire. The reliability test helped to determine if the items were consistently used to measure the constructs of interest.

In addition to this, the analysis of correlation was also performed in EXCEL to uncover the relationships between awareness, economic accessibility, obstacles to adoption and acceptance of AI-powered dental care. Furthermore, the impact of the independent variables on the respondents' willingness to use and support the AI-enabled dental services was assessed using regression. Excel provided a convenient and user-friendly avenue of statistical analysis and of visualizing research results.

2.8 Ethical Considerations

Ethical approval for this study was obtained from _____. Participation in the survey was voluntary, and informed consent was obtained from all respondents prior to data collection. Respondents were assured that their information would remain confidential and used solely for academic research purposes. No personal identifying information was disclosed during the study.

3. Results

The current paper evaluated how 50 subjects reacted to understand the views on the economic affordability of AI-enhanced dental care in a low- and middle-income context. The results of the collected data were interpreted using Microsoft Excel and descriptive statistics, reliability analysis, correlation analysis, and regression analysis. The results are discussed below.

3.1 Demographic Profile of Respondents

The demographic analysis revealed that the respondents had a wide range of social and economic backgrounds. Most respondents were in the 26-35 and 36-45 age categories which are more active working-age groups and are more prone to using digital technologies in healthcare. The respondents included both male and female respondents and respondents in the urban, semi-urban and rural areas to allow a variation in accessibility experience. Most of the respondents reported that they were familiar with digital healthcare systems, which means that an increased number of people are exposed to AI-pertinent healthcare technologies. The diversity of the interviewees supported the exploratory nature of the study and provided specifications of different socioeconomic attitudes to AI-assisted dental practice. The data presented in Table 1 show that many people have already had some experience with AI-powered healthcare services, suggesting that there is a high level of awareness about digital healthcare technologies among the respondents.

Table 1. Demographic Characteristics of Respondents (N = 50)

Variable	Category	Frequency	Percentage (%)
Gender	Male	27	54
	Female	23	46
Age Group	18–25	9	18
	26–35	16	32
	36–45	14	28

	46–55	7	14
	Above 55	4	8
Residential Area	Urban	21	42
	Semi-Urban	17	34
	Rural	12	24
AI Healthcare Usage	Yes	35	70
	No	15	30

3.2 Perceptions Regarding AI-Enabled Dental Care

The department must also identify perceptions about AI in dental care.What perceptions exist around AI in dental care must also be identified. The descriptive statistical analysis revealed that the perception towards the affordability and access to the dental service under the assistance of AI was generally favorable. The perviousness scores were high regarding the AI technologies to reduce waiting time, make the remote consultation services more accessible, and offer preventive dental services. The cost reduction and access to healthcare statements had a larger mean value, implying that AI can have a positive effect in reducing health disparities in underserved communities.

Table 2. Descriptive Statistics of Key Study Variables

Variable	Mean	Standard Deviation
Awareness of AI Dental Care	4.12	0.71
Accessibility of AI Services	4.06	0.68
Economic Affordability	4.18	0.64
Barriers to AI Adoption	3.74	0.82
Acceptance of AI Dental Care	4.25	0.59

The average was 4.25 as indicated in Table 2 implying that the respondents were highly accepting towards AI in dental care. Economic affordability also had high mean value which means that respondents believed that AI technologies can assist in reducing the cost of dental treatment. However, infrastructure, digital literacy and implementation cost was still an average challenge. Figure 1 presents the mean scores of the most essential variables of the study that indicate how the participants feel about the awareness, accessibility, economic affordability of the adoption of AI, potential barriers to the adoption of AI, and the level of acceptance of AI-enabled dental care.

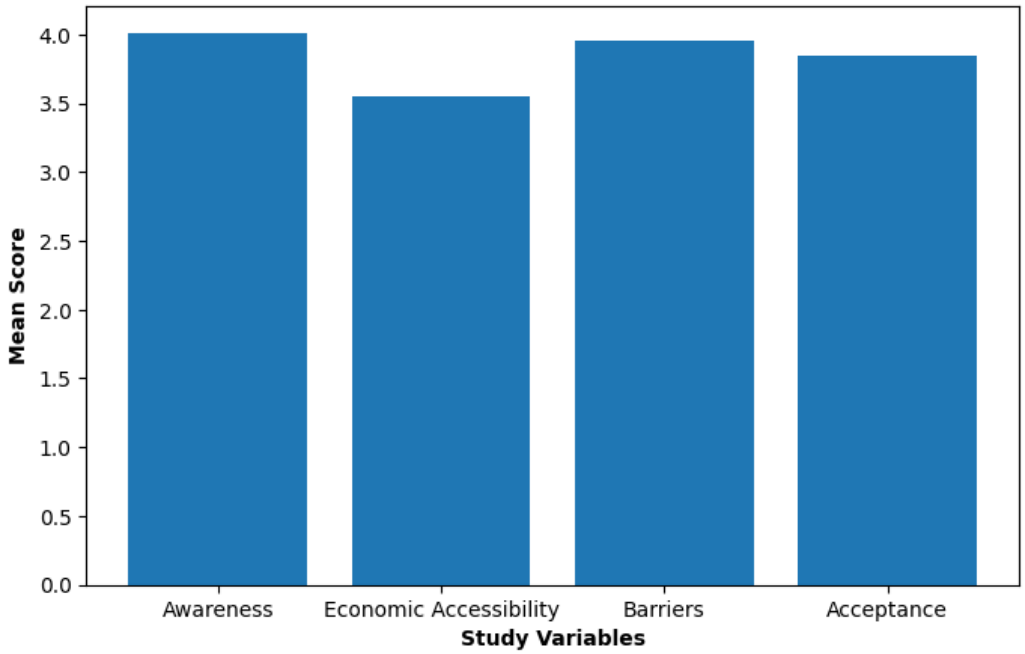

Figure 1. Mean Scores of Major Study Variables

The mean scores are depicted graphically, where the highest mean score was for acceptance of AI in dental care, followed closely by economic affordability and awareness. The mean values for the barriers to AI use were relatively low, but infrastructure and technical access were still seen by some respondents.

3.3 Reliability Analysis

Reliability testing was done to test the internal consistency of the questionnaire items. The reliability of the survey instrument was determined by Cronbach's Alpha which was computed using Excel and the results showed satisfactory reliability.

Table 3. Reliability Analysis of Questionnaire Constructs

Construct	Number of Items	Cronbach's Alpha
Awareness and Accessibility	5	0.81
Economic Accessibility	5	0.84
Barriers to Adoption	4	0.78
Acceptance and Policy Support	1	0.80
Overall Questionnaire Reliability	15	0.82

The parameters of reliability presented in Table 3 indicate that the items in the questionnaire are well consistent. The total Cronbachs Alpha of 0.82 shows that the survey tool was fairly reliable in assessing the perceptions of the respondents regarding access to dental care with the help of AI. Internal consistency and stability of the variables in the study were indicated by the reliability coefficients of the study constructs as presented in Figure 2.

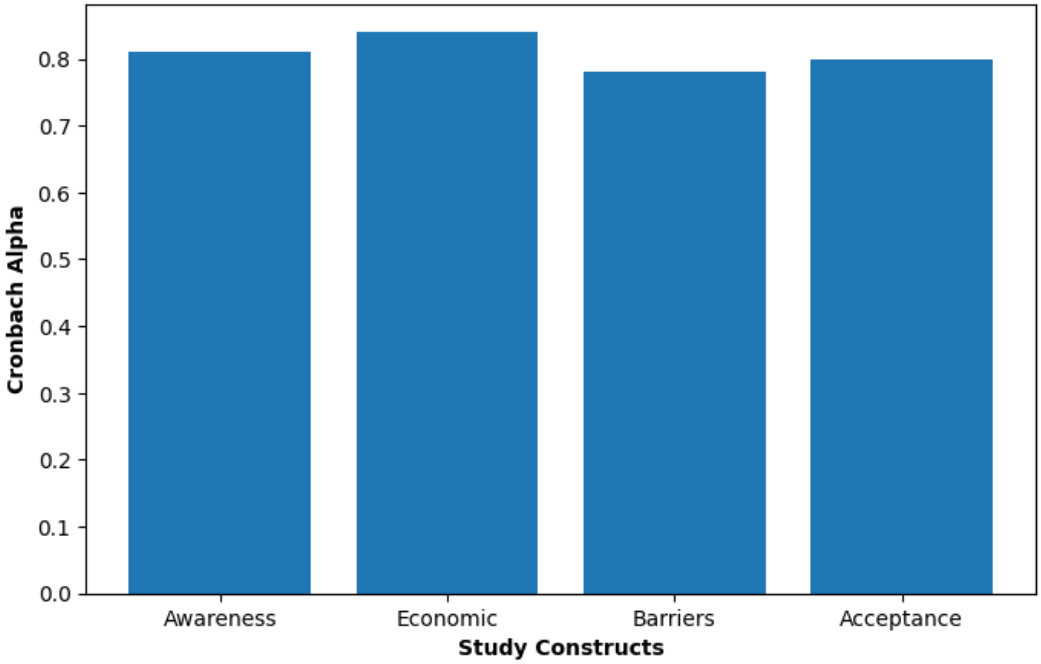

Figure 2. Reliability Coefficients of Study Constructs

The analysis of the reliability chart revealed that the Cronbach's alpha value for all constructs was greater than the acceptable value of 0.70, which showed that the measurement scale of the study had consistency and stability.

3.4 Correlation Analysis

Pearson correlation was conducted to explore the connection between awareness, affordability, barriers, and acceptance of AI-supported dental care. It was observed that awareness, acceptance, economic affordability and willingness to adopt were related in positive way from the analysis. AI-powered dental care that people felt was low-cost was associated with greater support for the broader adoption of AI in dental health care systems. However, key challenges like low infrastructure and technology limitations were associated with poorer acceptance rates.

The results indicate that raising awareness levels and making AI-supported dental services more accessible could make a substantial contribution to the acceptance of these services in low- and middle-income areas. Economic accessibility and acceptance of AI in dental care among respondents in LMSA can be seen in a positive relationship in Figure 3.

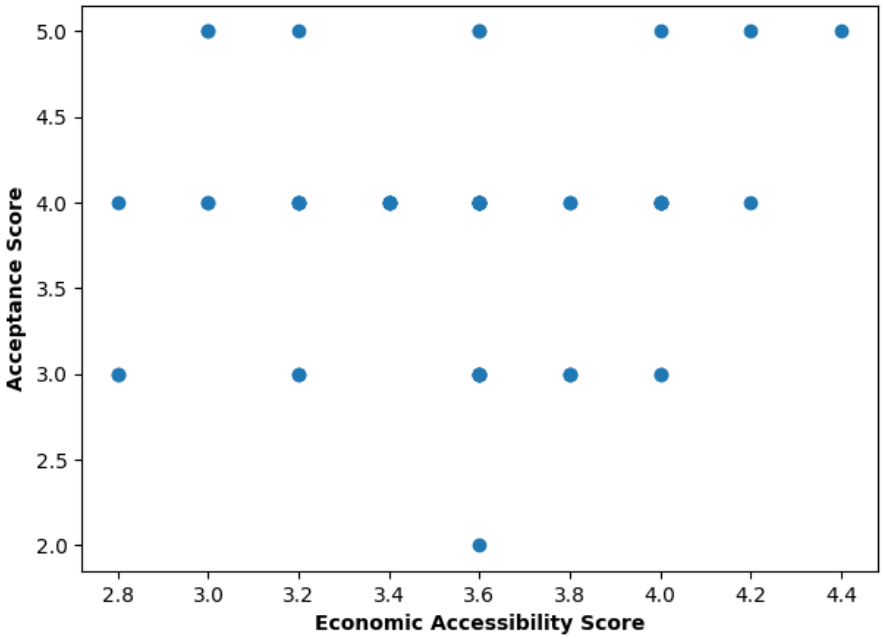

Figure 3. Relationship Between Economic Accessibility and Acceptance of AI Dental Care

The scatter plot showed that there was a positive correlation between the perception of economic accessibility and acceptance of AI-enabled dental services. The respondents with greater perceived affordability also indicated greater support for broader adoption of dental technologies based on AI.

3.5 Discussion of Key Findings

The findings show that the general attitude of respondents toward AI-based dental care was that it is an economically viable innovation capable of enhancing accessibility levels and decreasing the burden on the treatment process. The results confirm the hypothesis that AI technologies can be used to achieve more inclusive healthcare delivery systems in low-resource contexts. The respondents particularly noted the way AI can be used to reduce waiting time, expand the range of remote consultations in addition to reducing the healthcare expenditures on travelling.

The findings align with the general trends in healthcare digitization that are aimed at accessibility, efficiency, and cost-reduction. In the meantime, the respondents identified the major barriers to be the limitation of infrastructure, digital differences, and the implementation cost. These barriers highlight the importance of helping the government, implementing policies, and investing in the digital healthcare infrastructure to ensure that all people have access to AI-enabled dental services. Overall, the results indicate that AI technologies have a high potential to close the access to oral healthcare gaps in low- and middle-income environments in case of proper policy framework and inexpensive implementation strategies.

4. Discussion

The results of the current study suggest that AI-based dental care has a considerable potential to enhance economic accessibility and efficiency in healthcare in low- and middle-income environments. The vast majority of the respondents viewed AI technologies as able to lower the costs of treatment, decrease waiting times, and widen access to oral healthcare services. These results are consistent with the earlier findings indicating that artificial intelligence has the potential to improve healthcare delivery by automating it, making predictions, and clinical support systems based on data (Rajpurkar et al., 2022). Likewise, Topol noted that the merging of human skills and artificial intelligence could enhance the accuracy of healthcare and also minimize operational inefficiency (Topol, 2019).

Another result of the study was that the presence of technology was positively correlated with the acceptance of AI-enabled dental services by the population. The respondents believed that teledentistry and consultations with the assistance of AI can allow saving money on traveling and access specialists, particularly in rural areas. This is in support of past studies that digital health technologies could increase access to healthcare among underserved populations (Davenport & Kalakota, 2019). In addition, AI-based oral health management systems are also said to be efficient in enhancing preventive health and early diagnosis (Li et al., 2026). The growing role of AI in the field of oral healthcare sciences evidences that digital dentistry is becoming a part of a modern healthcare system (Dettori et al., 2025). These positive images were accompanied by a number of challenges to digital technologies raised by people, including problems with the infrastructure, the price of digital technologies, and a lack of technical literacy.

All these problems are symptomatic of more general problems associated with digitization of healthcare in developing economies. According to Reddy et al, a governance framework must exist to ensure secure and equitable deployment of artificial intelligence in healthcare systems (Reddy et al., 2020). Similarly, Alowais et al. pointed out that AI has the potential to

revolutionize clinical practice, yet insufficient digital infrastructures and regulatory obstacles could hinder its use in resource-constrained settings (Alowais et al., 2023). The issue of health equity came into the limelight of the research findings. Access to remote healthcare and better resource allocation are all possible through the application of AI to improve dental care and minimise oral healthcare inequalities. As highlighted by the World Health Organization, oral diseases remain a major global public health problem particularly for those who have limited access to health services (Organization, 2022). Artificial intelligence technologies can, therefore, contribute to offering more equal distribution of oral healthcare. Nevertheless, the advantages of digital healthcare will not be even among all population groups.

The unlinked vulnerable groups of people who lack access to the internet, are digitally illiterate or lack the financial capabilities can fall out of AI-based healthcare systems. This digital divide risk is worthy of the inclusion of the scope of integrated health care practices and infrastructure investment. The research findings implications on policy are that there is need to intervene and assist the policy with the assistance of the government. Digital healthcare programs may also lead to increased accessible services in low-resource locations via subsidies, a universal system to obtain AI-assisted dental care, and investing in digital infrastructure.

According to the FDI World Dental Federation, the incorporation of artificial intelligence into the dental field needs well-organized policy frameworks, ethics, and professional standards (Federation, 2025). The concept of AI-based oral healthcare can be further advanced in the sense of its financial feasibility and magnitude, through engaging in the public-private collaboration and funding mechanisms. It is also important that the findings have implications to healthcare providers and dental professionals. The oral healthcare systems are bound to transform current demands of the workforce due to the increased use of AI technologies. Dentists may require additional training related to the digital diagnostics, AI-assisted treatment planning, and healthcare informatics. Jiang et al. have pointed out that artificial intelligence has already started to transform healthcare practices by automating and smart decision-support systems (Jiang et al., 2017).

Equally, Bini opined that knowledge of machine learning and cognitive computing technologies will be an even greater necessity for healthcare professionals in the future (Bini, 2018). In terms of sustainability, AI-based dental care can help to achieve the goals of long-term healthcare efficiency and universal healthcare coverage. Artificial intelligence-based smart healthcare systems have the potential to streamline the allocation of healthcare resources, decrease the number of unnecessary clinical visits, and enhance the provision of preventive care (Gao et al., 2024). Scalability of AI-assisted dental services in low-resource settings can thus enhance the sustainability of healthcare as well as tackle dental professional shortages. Also, teledentistry solutions can facilitate environmentally friendly healthcare activities by decreasing the costs and resources associated with transportation (COURSE, 2024). The research however has a number of limitations.

The sample size was small and was aimed at exploratory analysis, which can limit the extrapolation of the results to different healthcare systems. Digital infrastructure, healthcare financing, and socioeconomic differences between LMICs might also have an impact on the results of AI adoption. Moreover, the research was based on perception-based answers, which can provide subjective bias and restrictions associated with publications (Hossam et al., 2025).

The studies that should be conducted in the future are longitudinal cost-effectiveness studies, cross-country comparative studies, and patient-centered affordability studies that will provide a clearer insight into the long-term effects of AI-enabled dental care. Further exploration of the rural implementation models and healthcare policy incorporation can also help to establish equitable digital oral healthcare development. The development of innovations in healthcare AI and technologies that are more geared towards sustainability also points to the necessity of conducting interdisciplinary studies that address the wider societal implication of the use of intelligent healthcare systems.

5. Conclusion

The current research has explored the economic access to AI-based dental services among low- and middle-income populations and the increased significance of artificial intelligence in revolutionizing the provision of oral care. The results indicated that the respondents tended to view AI technologies as resources in lowering the expenses of treatment, enhancing the effectiveness of diagnoses, reducing the number of waiting times, and increasing access to dental services with the help of teledentistry and digital healthcare services. These findings indicate that AI-enabled dental services can help to solve major issues of healthcare accessibility in underserved and resource-limited populations. The study also revealed other obstacles that can restrict the successful adoption of AI technologies in dentistry, such as the insufficient digital infrastructure, a lack of technological understanding, regulatory issues, and affordability of advanced healthcare systems. Nevertheless, the challenges did not stop the respondents, as they strongly supported the broader use of AI-assisted dental services, especially, with the help of government investment, healthcare subsidies and policy-based strategies in digital healthcare. Altogether, the study highlights that AI-enabled dental care has the potential to make oral healthcare systems more inclusive, efficient, and sustainable provided it is put into practice in an equitable manner. Policymakers, healthcare organizations, and dentists should collaborate in such a way that technology advances do not enhance healthcare disparities but rather enhance healthcare access among the vulnerable groups. Long-term economic viability, patient-focused affordability, and scalable models of implementation should be considered in future research to enhance the adoption of AI in the global oral healthcare system.

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